

# Public communication of science 2.0

*Is the communication of science via the “new media” online a genuine transformation or old wine in new bottles?*

Hans Peter Peters<sup>1</sup>, Sharon Dunwoody<sup>2</sup>, Joachim Allgaier<sup>3</sup>, Yin-Yueh Lo<sup>1</sup> & Dominique Brossard<sup>4</sup>

The communication between scientists and the public is changing. Major drivers of this change are the rapid evolution of the Internet, now in its web 2.0 version with an abundance of video-sharing websites, blogging platforms and social networks; the ubiquity of mobile devices; and the merging of individual and public communication. The new infrastructures allow nearly instantaneous access to information and make it much easier for communicators—both professionals and laypersons—to directly address a broad audience. Web-based services have broken down technical and economic barriers that, in the traditional communication system, have separated professional communicators from the largely passive audience of traditional print and broadcast media. This interactivity among the participants of online communication potentially transcends the traditional model of mass communication—by which the information is transmitted from a sender, that is, the scientists, via journalists to the audience. Here, we discuss what the new media may hold in store for scientists and their efforts to communicate with different publics.

Not all forms of online communication are conceptually different from traditional media, though. For the typical news consumer, the difference between reading the print edition of a newspaper or accessing it online may be trivial. They may derive some added value from other readers' responses or from information about how often an article was shared by Twitter or Facebook, but these are rather secondary aspects. It seems that the traditional media, such as newspapers and magazines, are

easily integrated into the Internet: their content is frequently referenced in blogs, shared in social networks, included in so-called news aggregators, such as Google News, and turns up in search results. In addition, traditional media increasingly provide additional content online, notably multimedia content, and link to further information and interactivity, notably reader comments. Click rates, shares and other response measures provide instant feedback to professional communicators who, in the traditional media environment, had to rely on measures such as news-stand sales figures, letters to the editor and viewer ratings.

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In addition to their own online presentation, content producers heavily use social media, such as Twitter and Facebook, not only to disseminate their products, but also as marketing tools. Many science writers announce their articles on Facebook and Twitter; universities and other research organizations use social media to distribute their press releases; and scientists highlight their publications in ResearchGate or via Twitter, hoping to attract more readers, citations and gain wider social impact. Access

to online newspapers, magazines, journals or press releases, the marketing of that content and consumption patterns are thus strongly affected by social media. Additionally, traditional content providers such as journalists often use blogs and social networks as information sources for their articles.

However, online communication does not necessarily imply a turn away from classical, journalism-based media. Although the different structures of communication channels can have profound influences on the narratives, we think it is important to distinguish between new ways of producing original content—such as popular information about scientific projects, findings and applications—and new ways of sharing, accessing and using it.

The consequences of these developments for public science communication cannot yet be fully anticipated. Most obvious are changes in communication strategies, that is, the use of communication channels and corresponding “formats” by which scientists and scientific organizations address the public. Many audiences relevant to science are now online, and communicators have to meet them there. Science blogs, Twitter, Facebook, Google+ and YouTube now play a significant role—often providing original content but also directing attention to projects, findings, events, scientific publications, reports or political decisions relevant to science [1].

The new media, by offering new communication channels and formats, may—in the long run—fundamentally transform the interface between science and society.

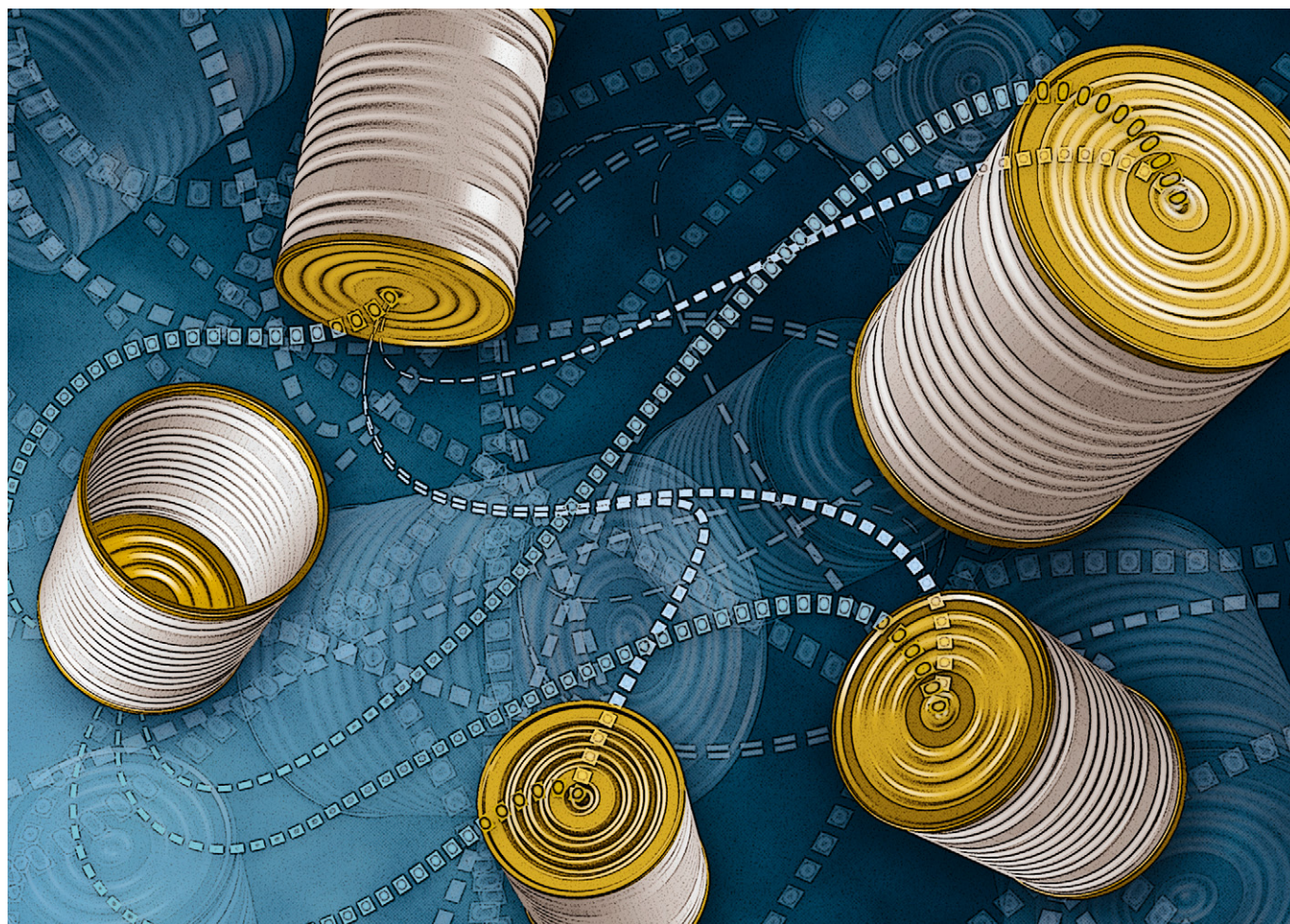
1 Institute of Neuroscience and Medicine, Forschungszentrum Jülich, Germany. E-mail: h.p.peters@fz-juelich.de

2 School of Journalism and Mass Communication, University of Wisconsin-Madison, Madison, WI, USA

3 Institute of Science, Technology and Society Studies, Alpen-Adria-Universität Klagenfurt, Austria

4 Department of Life Sciences Communication, University of Wisconsin-Madison, Madison, WI, USA

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Researchers in the hard sciences still tend to regard public communication of science as different from internal scientific communication, notably, scientific publications, conferences and workshops. While this belief has probably always been simplistic [2], it is particularly questionable in the online environment, where professional communication among scientists and public communication about science are not clearly separated. As the discussion about Open Access publishing shows, the concept of purely internal scientific communication is becoming more and more unacceptable to “netizens”, including scientists themselves. An overlap of “scientific communication” and “public communication of science” may strengthen the interdependency between science and civil society and lead to a more efficient transfer of knowledge from science into society. But it may also portend repercussions of public communication on scientific research and science governance. Some dread such repercussions as corrupting influences that could result in the de-professionalization

of science [3], while others welcome increased public engagement with science and technology [4].

Increased interactivity and participation do not automatically lead to improved public dialogue, though. For example, a recent experiment studying the effects of comments on readers’ reception of science stories demonstrated the polarization of risk perception regarding nanotechnology processes when readers were exposed to “uncivil” comments from other readers [5]. Citing this study, the US science magazine *Popular Science* decided to eliminate reader comments, arguing that they may hinder public discussion of science more than they would help it (<http://www.popsoci.com/science/article/2013-09/why-were-shutting-our-comments>). Such findings indicate that we should be cautious when talking about the deliberative potential of the Internet, which may vary depending on the context.

Both the motivation and the ability of non-scientists to join in communication vary by field of research and its possible applica-

tions. It will remain the exception rather than the rule that professional discourse among scientists and public discourse merge, but the new media may increase the likelihood that citizens or stakeholders can influence scientific research and science governance on the level of individual research projects. Whether scientists welcome the involvement of non-scientists depends on their expectations about whether this public engagement will support their own goals and research interests—for instance, those seeking crowd funding for their work or support by amateur scientists—or whether they fear that it may threaten their work in contested areas, such as evolutionary biology or animal experiments [6]. Surveys show that while scientists favour transparency and agree, for example, that the public should be informed when scientists disagree about relevant topics, they are more reserved about the public’s participation in science governance [7]. Citizens themselves may not be ready to participate in such governance, either [8]. It is, therefore, likely that the growing support for Open



Access among scientists is meant to increase the transparency of science to outsiders but is not necessarily an invitation to actively participate in the creation and evaluation of scientific knowledge.

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A crucial issue is the role of science journalism in the online environment, since journalists have been the mediators in the classic communication model. Many traditional media organizations have found it difficult to establish successful payment models for online content or to raise money from advertisers. At the same time, the profits from print products are decreasing because readers and advertisers increasingly turn to online channels. The economic crisis facing print media has already forced the end of the print edition of reputable newspapers and magazines, such as *U.S. News & World Report*, and led to the reduction of science editorial staff, for instance at CNN (<http://dotearth.blogs.nytimes.com/2008/12/04/science-coverage-imploding-at-cnn-beyond>). On the other hand, successful online editions of traditional media, such as *Spiegel Online* in Germany, have been hiring science journalists, and online-only products such as *Re/Code* (<http://recode.net/about>), *FiveThirtyEight* (<http://fivethirtyeight.com/>) and *inside climate news* (<http://insideclimate.news.org/about>) tout the quality of their science journalists.

One of the reasons for the economic crisis of traditional media is the loss of their quasi-monopoly over providing time-sensitive, topical information to a broad public. For example, universities in the pre-Internet era depended on journalists to pick up their press releases and make the information available to the public; these press releases are now disseminated via online sites directly accessible to anyone. Moreover, many press releases are written in a journalistic format, ready for consumption by the end-user, and may have even been written by former science journalists. Journalistic

content has to compete with free content, some of which is professionally produced. The big question is whether the current crisis is the beginning of the collapse of journalistic media in general and science journalism in particular or a temporary downturn until the media adapt to the new online environment.

While, in general, audiences increasingly use online sources and social networks, the patterns differ somewhat by country. A Eurobarometer survey conducted in 2013 revealed that most Europeans still obtain their information about science and technology from TV (65%) and newspapers (33%). Websites (32%) ranked third in the list of information sources, but only 10% said that they get information about science and technology from “social media or blogs” [9]. When answering the question about websites, many of the respondents were likely thinking of the online products of traditional media companies. This seems to be different in the USA where, in 2012, “42% of Americans cited the Internet as their primary source of S&T information, up from 35% in 2010” [10].

It is not possible to compare US and European data directly because of different question formats—the Eurobarometer allowed multiple answers while the US survey asked about the main information source, for example—but science news consumption in the USA seems to differ from that of Europe, suggesting a more rapid shift towards non-journalistic online sources. However, it is important to clearly distinguish two different trends that do not necessarily align: a trend away from print and broadcast media towards online media, which is quite obvious and universal, and a trend away from journalism to a variety of other sources ranging from public relations, individual bloggers and user-generated content in social networks, which is less well understood.

Although generalizations are problematic, people who seek specific information, such as patients looking for information about their disease or high school students preparing a presentation, tend to favour the Internet and non-journalistic sources. Other users, with less focused interest, may prefer a journalistic selection of topics and the presentation formats by print and broadcast journalism. An early study found that recipi-

ents of science information in an online context tended to prefer linear “stories” over jumping from information piece to information piece presented as hypertext [11]. While one may expect that audiences have adapted to the new media and their specific formats, the experience from the introduction of TV in the 1950s suggests that new channels only partly substitute for existing ones.

Most scientists continue to use “classic” media and consider these more influential in public communication than the new online media. An online survey of neuroscientists in Germany and the USA asked which general information sources the scientists typically use “to follow news and information about scientific issues”. Furthermore, they were asked to indicate the impact of each information source on public opinion and science policy [12]. More than 95% of the respondents indicated that they use journalistic sources in print or on air, and 80% said that they access these sources online. They less frequently mentioned blogs (19%) or social networks (11%) as information source; US researchers tend to use blogs and social networks more frequently than German researchers. A similar depreciation of online sources compared to print media was also found in a study of German university decision-makers [13].

Almost all researchers considered “national newspapers in print” to have a strong influence on public opinion and political decision-making. Interestingly, a little more than half of the respondents acknowledged that blogs and social networks were also influential. Reflecting different trends in science news consumption, US researchers were more likely to assert the impact of social online media than German researchers. For example, almost twice as many US researchers considered blogs (61% versus 34%) and social networks (41% versus 22%) to have “a strong influence on political decision-making”. It remains unclear whether the data reflect a permanent difference or just a time lag in a general trend.

Turning from consumption to production, online media offer scientists more opportunities to communicate directly with the general public rather than having to rely on journalists as mediators. Some are already taking up this offer, and

more certainly will. Even before the rise of blogging or other forms of online communication, scientists had many opportunities to take on the role of author in the public sphere. In a cross-national survey of biomedical researchers, between 36% (Germany) and 13% (USA) of the respondents indicated that they had written an article for a newspaper or a non-scientific journal in the past 3 years [7]. Similarly, a comparison of scientific and popular publishing by scientists from 13 countries found that about one-third of scientists had published a popular science article in 2005–2007 [14].

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From the point of view of scientists and scientific organizations, there are advantages and disadvantages to being an “information source” for journalists and communicating directly with the public. One important factor is the implied control over the message. A number of commentaries and analyses dealing with journalists’ inaccuracies and biases in the coverage of science and technology recognize a strong demand among scientists for control over coverage; for example, biomedical researchers from five countries strongly agreed that “Journalists should permit scientists to check stories in which they are quoted prior to publication” and disagreed with the statement that “Journalists should have the last say in how a scientific topic is covered” [7]. Furthermore, journalists and editors are very selective in deciding which story they cover and which not. The Internet therefore provides an easy alternative to directly address the public independent of journalists or editors.

However, communicating with laypeople is no trivial task and requires motivation, time and communication skills. It remains to be seen whether the majority of scientists, in addition to their duties as researchers, teachers, science managers and committee members, will add public communication to their routine activities. Some will continue to delegate this task to public information offi-

cers or other professionals [15]. While most (leading) scientists nowadays accept public communication as part of their role, for most it is still second to their main tasks of research, publishing, teaching and grant proposal writing. Furthermore, talking to the public online does not imply that somebody is listening.

If scientists as communicators become relatively more important than the journalistic mediation of science, it could have implications for the public representation of science. If journalistic selection is replaced by self-selection, the topics presented to the public and who presents them will inevitably change. Which selection criteria will become dominant in a post-journalistic area: individual scientists choosing to engage in public communication, research organizations with the most aggressive public relations department, or those who find resonance with the audience? Very likely, factors, such as motivation, resources and communication skills, which have always been important, will become even more relevant to the visibility of science.

Finally, turning from journalistic coverage to direct communication implies a shift from *external observation* to *self-presentation* of science. Selection by journalists and editors implies social relevance: coverage in the *New York Times* sends a different message of importance than stories lodged on the website of a university. Self-presentation of science cannot replace the signalling/surveillance function performed by journalists and editors when they select something as relevant for public consumption.

Whatever the future will bring, the complexity of the new media landscape increases as the structure of communication becomes more granular. It offers many new opportunities and options for science to communicate with public. Online communities are developing that are devoted to specific scientific interests; these communities are small but extremely beneficial for the participants. The traditional media system, in particular journalism, will adapt to the online environment and will continue to provide major content with the concomitant social legitimacy that their selection provides. The new communication environment will be a mixture of journalistic media—increasingly online—and social media, and both will be interdependent in many ways. Scientific communicators should

embrace the social media and experiment with them, but whether these channels will replace the established ways of journalistic observation of science remains to be seen.

## Conflict of interest

The authors declare that they have no conflict of interest.

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